REMARKS

Claims 1-12, 15-17, 20-25, 27-30, 32-35, 37-40, 42, 47-48, and 50-67 have been amended. Claims 13-14, 45, 50, and 64-65 have been canceled. Claims 69-102 have been added. Claims 1-12, 15-44, 46-49, 51-63, and 66-102 are now pending. A Petition for Extension of Time (one-month) is being filed concurrently herewith. Applicants reserve the right to pursue the original claims and other claims in this and other applications. Applicants respectfully request reconsideration of the above-referenced application in light of the amendments and following remarks.

The Title of the Invention has been amended to correspond more closely to the pending claims. No new matter has been added. The Examiner's approval is solicited.

At the outset, Applicant acknowledges with appreciation the Examiner's indication that claims 3-6, 8-9, 11-14, 16-22, 24-25, 27, 29-30, 32, 34-35, 37, 39-40, 42, 44-46, 59-51, 55-58, 60-65, and 68, would be in condition for allowance if rewritten into independent form including all of the limitations of their base claim and any intervening claims (Office Action, pg. 3). Applicants respectfully submit that their independent base claims should be allowable for at least the reasons set forth below.

Claims 9 and 14 stand objected to because of informalities. As instructed by the Examiner, claims 9 and 14 have been amended to recite an "erase pulse" rather than a "write erase pulse." The objection is requested to be withdrawn.

Claims 1, 2, 7, 10, 15, 23, 26, 28, 31, 33, 36, 38, 41, 43, 47, 48, 52-54, 59, 66, and 67 stand rejected under 35 U.S.C. § 102(e) as being anticipated by U.S. Patent No. 6,768,665 ("Parkinson"). The rejection is respectfully traversed.

In an anticipation rejection, "[n]o question of obviousness is present. In other words, for anticipation under 35 U.S.C. 102, the reference must teach <u>every aspect</u> of the claimed invention either explicitly or impliedly. Any feature not directly taught must be inherently present." M.P.E.P. § 706.02. No argument for inherency has been set forth in the Office Action. Accordingly, Applicants respectfully submit that the Office Action has not set forth a proper case of anticipation under 35 U.S.C. § 102(e). Parkinson does not disclose or teach, explicitly or inherently, <u>every aspect</u> of Applicants' claimed invention that is recited in claims 1, 2, 7, 10, 15, 23, 26, 28, 31, 33, 36, 38, 41, 43, 47, 48, 52-54, 59, 66, and 67. For this reason alone, the 35 U.S.C. § 102(e) rejection should be withdrawn.

Claim 1 defines a method for controlling resistance variation in a variable resistance memory device and recites "a) determining a variable resistance memory cell to be in either an "on" state or an "off" state based on a resistance of the memory cell; b) if the memory cell is determined to be in the "on" state, determining if the resistance of the memory cell is outside a predetermined resistance range for the "on" state; c) if the memory cell is categorized as being in the "off" state, determining if the resistance of the memory cell is outside a predetermined resistance range for the "off" state; and d) shifting the resistance of said memory cell to said predetermined resistance range for either the "on" or "off" state by applying at least one reset pulse to said memory cell if the condition tested for in either b) or c) is determined to exist in the memory cell." Parkinson does not disclose such a method.

An aspect of the claimed invention is directed to "shifting the resistance of said memory cell to said predetermined resistance range for either the "on" or "off" state by applying at least one reset pulse to said memory cell," as recited in claim 1. Parkinson, in contrast, is directed to applying a voltage of single polarity to achieve an amorphous or crystalline state for a phase-change material. Parkinson is not directed to

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shifting the resistance of the memory cell to a predetermined resistance range; but, instead, corrects for resistance value programming variation by rewriting or refreshing memory cells that are within a predefined resistance range. To this end, Parkinson discloses that "if the memory device determines . . . that the exhibited resistance is outside of the predefined margin, then the memory device does not perform the refresh. Otherwise, if within the margin, the memory device prepares to rewrite the memory cell with the current data bit that is indicated by the memory cell to refresh the cell's resistance." (Col. 4, lines 58-64).

The Office Action asserts that Parkinson, in col. 5, line 7, discloses applying Applicants' recited reset pulse. This is not true. Parkinson's reset pulse is only applied if the resistance of the memory cell is within a predetermined range. If the memory cell's resistance is within the prescribed range, Parkinson's reset pulse is applied to refresh the memory cell's resistance. This is the only time that Parkinson's reset pulse is applied. Applicants' recited reset pulse, however, is applied when the resistance of the cell is outside of the predetermined range. Parkinson does not disclose that the reset pulse is used for "shifting the resistance of said memory cell to said predetermined resistance range for either the "on" or "off" state . . . if the condition tested for in either b) or c) is determined to exist in the memory cell," as recited in claim 1.

Applicants' recited reset pulse shifts a programmed, but deviated, resistance of the memory cell to within an original resistance range corresponding to the programmed state of the memory cell. For instance, if the memory cell is "on" and should be within a certain range, the reset pulse shifts the resistance of the memory cell such that its resistance falls within that prescribed range. Applicants' claimed reset pulse is applied when the resistance of the cell is outside the prescribed range which is completely different from Parkinson's reset pulse. As indicated above, Parkinson's reset pulse is only applied when the resistance of the cell is within the prescribed range.

In this manner, Parkinson's reset pulse does not shift the resistance of the cell; but, merely refreshes it.

The Office Action further asserts that Parkinson discloses restoring the original resistance profile of the memory cell. This is not correct since Parkinson discloses <u>rewriting</u> the memory cell to <u>refresh</u> the cell's resistance only when the resistance of the memory cell is within the prescribed range (Col. 4, lines 62-64). As such, Parkinson does not teach a method for controlling resistance variation in a variable resistance memory device which shifts the resistance of the memory cell if it has fallen outside a predetermined range, as defined by claim 1.

Claims 2, 7, 10, and 15 depend from independent claim 1 and should be similarly allowable along with independent claim 1 for at least the reasons provided above, and on their own merits. In particular, Parkinson does not teach that the "act of determining if the resistance of the memory cell is outside a predetermined resistance range for the "on" state further comprises determining if the resistance of the memory cell is greater than a predetermined maximum resistance for the "on" state," as recited in dependent claim 2. Parkinson does not teach that the "act of determining if the resistance of the memory cell is outside a predetermined resistance range for the "on" state further comprises determining if the resistance of the memory cell is less than a predetermined minimum resistance for the "on" state," as recited in dependent claim 7. Parkinson does not teach that the "act of determining if the resistance of the memory cell is outside a predetermined resistance range for the "off" state further comprises determining if the resistance of the memory cell is less than a predetermined minimum resistance for the "off" state," as recited in dependent claim 10.

Similarly, Parkinson does not teach that the "act of determining if the resistance of the memory cell is outside a predetermined resistance range for the "off" state further comprises determining if the resistance of the memory cell is greater than a predetermined maximum resistance for the "off" state," as recited in dependent claim 15. As indicated above, Parkinson <u>rewrites</u> the memory cell to <u>refresh</u> its resistance if the cell is within a prescribed resistance range. Parkinson is not directed to "<u>shifting</u> the resistance of said memory cell to said predetermined resistance range for either the "on" or "off" state by applying at least one reset pulse to said memory cell if the condition tested for in either b) or c) is determined to exist in the memory cell," as recited in independent claim 1.

Since Parkinson does not disclose the method of independent claim 1 or dependent claims 2, 7, 10, and 15, Applicants respectfully requests that the 35 U.S.C. § 102(e) rejection of claims 1-2, 7, 10, and 15 be withdrawn.

Claim 23 defines a method of controlling an undererase drift condition in a variable resistance memory cell and recites "a) comparing the resistance of the memory cell with a reference resistance range and identifying the memory cell as being programmed to a high resistance state if the resistance is above the reference resistance range; b) if the memory cell is identified as being programmed to the high resistance state, comparing the resistance of the memory cell with a predetermined minimum resistance; and c) if the resistance of the memory cell is not greater than the predetermined minimum resistance, applying at least one reset pulse to the memory cell to shift the memory cell to an original resistance range for the high resistance state of the memory cell." Parkinson does not teach such a method.

Applicants' recited reset pulse <u>shifts</u> a programmed resistance of a memory cell to return to an original resistance range for the current state already programmed to the memory cell. For instance, if the memory cell is programmed to a high resistance state, but is outside an acceptable resistance range for the high resistance state, the reset pulse <u>shifts, not refreshes</u>, the resistance of the memory cell such that its resistance level is <u>within</u> that prescribed range.

Claim 26 depends from claim 23 and should be similarly allowable along with claim 23 for at least the reasons provided above, and on its own merits. In particular, Parkinson does not teach that "the memory cell is a PCRAM cell," as recited in dependent claim 26. Since Parkinson does not disclose the method of independent claim 23 or dependent claim 26, Applicants respectfully request that the 35 U.S.C. § 102(e) rejection of claims 23 and 26 be withdrawn.

Claim 28 defines a method of controlling an underwrite drift condition in a variable resistance memory cell and recites "a) comparing a resistance of the memory cell with a reference resistance range and identifying the memory cell as being programmed to a low resistance state if the resistance is below the reference resistance range; b) if the memory cell is identified as being programmed to the low resistance state, comparing the resistance of the memory cell with a predetermined maximum resistance; and c) if the resistance of the memory cell is not less than the predetermined maximum resistance, applying at least one reset pulse to the memory cell to shift the memory cell to an original resistance range for the low resistance state of the memory cell." Parkinson does not teach such a method.

Applicants' recited reset pulse <u>shifts</u> a programmed resistance of a memory cell to return to a reference resistance range for the current state already programmed to the memory cell. For instance, if the memory cell is programmed to a low resistance

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state but is outside an acceptable resistance range for the low resistance state, the reset pulse <u>shifts,</u> <u>not refreshes,</u> the resistance of the memory cell such that its resistance level is <u>within</u> that prescribed range.

Claim 31 depends from claim 28 and should be similarly allowable along with claim 28 for at least the reasons provided above, and on its own merits. In particular, Parkinson does not teach that "the memory cell is a PCRAM cell," as recited in dependent claim 31. Since Parkinson does not disclose the method of independent claim 28 or dependent claim 31, Applicants respectfully request that the 35 U.S.C. § 102(e) rejection of claims 28 and 31 be withdrawn.

Claim 33 defines a method of controlling an overerase drift condition in a variable resistance memory cell and recites "a) comparing the resistance of the memory cell with a reference resistance range and identifying the memory cell as being programmed to a high resistance state if the resistance is above the reference resistance range; b) if the memory cell is identified as being programmed to the high resistance state, comparing the resistance of the memory cell with a predetermined maximum resistance; and c) if the resistance of the memory cell is greater than the predetermined maximum resistance, applying at least one reset pulse to the memory cell to shift the memory cell to an original resistance range for the high resistance state of the memory cell." Parkinson does not teach such a method.

Applicants' recited reset pulse <u>shifts</u> a programmed resistance of a memory cell to return to a reference resistance range for the current state already programmed to the memory cell. For instance, if the memory cell is programmed to a high resistance state, but is outside an acceptable resistance range for the high resistance state, the reset pulse <u>shifts,</u> <u>not refreshes,</u> the resistance of the memory cell such that its resistance level is <u>within</u> that prescribed range.

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Claim 36 depends from claim 33 and should be similarly allowable along with claim 33 for at least the reasons provided above, and on its own merits. In particular, Parkinson does not teach that "the memory cell is a PCRAM cell," as recited in dependent claim 36. Since Parkinson does not disclose the method of independent claim 33 or dependent claim 36, Applicants respectfully request that the 35 U.S.C. § 102(e) rejection of claims 33 and 36 be withdrawn.

Claim 38 defines a method of controlling an overwrite drift condition in a variable resistance memory cell and recites "a) comparing a resistance of the memory cell with a reference resistance range and identifying the memory cell as being programmed to a low resistance state if the resistance is below the reference resistance range; b) if the memory cell is identified as being programmed to the low resistance state, comparing the resistance of the memory cell with a predetermined minimum resistance; and c) if the resistance of the memory cell is greater than the predetermined minimum resistance, applying at least one reset pulse to the memory cell to shift the memory cell to an original resistance range for the low resistance state of the memory cell." Parkinson does not teach such a method.

Applicants' recited reset pulse <u>shifts</u> a programmed resistance of a memory cell to return to a reference resistance range for the current state already programmed to the memory cell. For instance, if the memory cell is programmed to a low resistance state, but is outside an acceptable resistance range for the low resistance state, the reset pulse <u>shifts, not refreshes,</u> the resistance of the memory cell such that its resistance level falls <u>within</u> that prescribed range.

Claim 41 depends from claim 38 and should be similarly allowable along with claim 38 for at least the reasons provided above, and on its own merits. In particular, Parkinson does not teach that "the memory cell is a PCRAM cell," as recited

in dependent claim 41. Since Parkinson does not disclose the method of independent claim 38 or dependent claim 41, Applicants respectfully request that the 35 U.S.C. §.102(e) rejection of claims 38 and 41 be withdrawn.

Claim 43 defines a method for operating a PCRAM memory device, and recites "determining if a resistance of a PCRAM memory cell programmed to a high resistance state has deviated from an original resistance range for a high resistance state thereof; and applying at least one voltage potential to the PCRAM memory cell to shift the PCRAM memory cell to within the original resistance range for the high resistance state." Parkinson does not teach such a method.

Applicants' recited at least one voltage potential <u>shifts</u> a programmed resistance of the memory cell to return to an original resistance range for the current state already programmed to the memory cell. For instance, if the memory cell is programmed to a high resistance state and is outside an acceptable resistance range for the high resistance state, the at least one voltage potential <u>shifts, not refreshes,</u> the resistance of the memory cell such that its resistance level is <u>within</u> that prescribed range for the high resistance state.

Claim 47 depends from claim 43 and should be similarly allowable along with claim 43 for at least the reasons provided above, and on its own merits. In particular, Parkinson does not teach that the "at least one voltage potential is applied when the resistance of the PCRAM memory cell is determined to have deviated from the original resistance range," as recited in dependent claim 47. As indicated previously, Parkinson does not apply a pulse when the resistance is determined to fall outside of the original resistance range. Since Parkinson does not disclose the method of independent claim 43 or dependent claim 47, Applicants respectfully request that the 35 U.S.C. § 102(e) rejection of claims 43 and 47 be withdrawn.

Claim 48 defines a method for operating a PCRAM memory device and recites "determining if a resistance of a PCRAM memory cell programmed to a low resistance state has deviated from an original resistance range for a low resistance state thereof; and applying at least one voltage potential to the PCRAM memory cell to shift the PCRAM memory cell to within the original resistance range for the low resistance state." Parkinson does not teach such a method.

Applicants' recited at least one voltage potential shifts a programmed resistance of the PCRAM memory cell to return to an original resistance range for the current state already programmed to the memory cell. For instance, if the memory cell is programmed to a low resistance state and is outside an acceptable resistance range for the low resistance state, the at least one voltage potential shifts, not refreshes, the resistance of the memory cell such that its resistance level is within that prescribed range for the low resistance state.

Claim 52 depends from claim 48 and should be similarly allowable along with claim 48 for at least the reasons provided above, and on its own merits. In particular, Parkinson does not teach that the "the at least one voltage potential is applied when the resistance of the PCRAM memory cell is determined to have deviated from the original resistance range," as recited in dependent claim 52. As indicated previously, Parkinson does not apply a pulse when the resistance is determined to fall outside of the original resistance range. Since Parkinson does not disclose the method of independent claim 48 or dependent claim 52, Applicants respectfully request that the 35 U.S.C. § 102(e) rejection of claims 48 and 52 be withdrawn.

Claim 53 defines a method for operating a PCRAM memory device and recites "determining that a resistance profile of a PCRAM memory cell has deviated from a programmed resistance profile of the PCRAM memory cell; and applying at least one voltage potential to the PCRAM memory cell to shift the resistance of the PCRAM memory cell to the programmed resistance profile for the PCRAM memory cell." Parkinson does not teach such a method.

Applicants' recited at least one voltage potential shifts a deviated programmed resistance of the PCRAM memory cell to return to a programmed resistance profile for the PCRAM memory cell. Thus, the at least one voltage potential shifts, not refreshes, the resistance of the memory cell such that its resistance level is within that programmed resistance profile. Since Parkinson does not disclose the method of independent claim 53, Applicants respectfully request that the 35 U.S.C. § 102(e) rejection of claim 53 be withdrawn.

Claim 54 defines a method of operating a PCRAM memory device and recites "determining if a variable resistance memory cell is an "on" state or an "off" state based on a current resistance of the memory cell; and applying at least one pulse of sufficient magnitude and/or duration to the memory cell to shift the memory cell to an original resistance range for the memory cell based on the "on" or "off" state of the cell." Parkinson does not teach such a method.

Applicants' recited at least one pulse of sufficient magnitude and/or duration shifts a current resistance of the variable resistance memory cell to return to an original programmed resistance range for the memory cell based on the "on" or "off" state of the memory cell. Thus, the at least one pulse of sufficient magnitude and/or duration which shifts, not refreshes, the resistance of the memory cell such that its resistance level is within that original programmed resistance range. Since Parkinson does not

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disclose the method of independent claim 54, Applicants respectfully request that the 35 U.S.C. § 102(e) rejection of claim 54 be withdrawn.

Claim 59 defines a memory device and recites "an array of variable resistance memory cells; and a controller coupled to the memory array which periodically performs an algorithm to detect resistance profile drift in the memory cells of the array, and which restores an original resistance profile in any of said memory cells in which resistance profile drift is detected by applying at least one pulse with sufficient magnitude and/or duration to shift the current resistance of the memory cells to the original resistance profile of said memory cells." Parkinson does not teach such a memory device.

Applicants' recited memory device with at least one pulse with sufficient magnitude and/or duration <u>shifts</u> a programmed resistance of the memory cell, which has undergone resistance profile drift, to return to an original programmed resistance profile for the memory cell. Thus, the memory device applies at least one pulse of sufficient magnitude and/or duration which <u>shifts, not refreshes,</u> the resistance of the memory cell such that its resistance level is <u>within</u> that original programmed resistance profile. Since Parkinson does not disclose the method of independent claim 59, Applicants respectfully request that the 35 U.S.C. § 102(e) rejection of claim 59 be withdrawn.

Claim 66 defines a processor system and recites "a processor for receiving and processing data; at least one memory array of variable resistance memory cells for exchanging data with the processor; and a controller connected to the at least one memory array, wherein the controller manages memory access requests from the processor to the at least one memory device, periodically performs an algorithm to detect resistance profile drift in the memory cells of the array, and restores an original

resistance profile in any memory cell in which resistance profile drift is detected."
Parkinson does not teach such a processor system.

Applicants' recited processor system <u>restores</u> a programmed resistance of the
memory cell, which has undergone resistance profile drift, to return to an original
programmed resistance profile for the memory cell. Thus, the memory device <u>restores,</u>
<u>not refreshes,</u> the resistance of the memory cell such that its resistance level is <u>within</u>
that original programmed resistance profile. Since Parkinson does not disclose the
method of independent claim 66, Applicants respectfully request that the 35 U.S.C. §
102(e) rejection of claim 66 be withdrawn.

Claim 67 defines a processor system and recites "a processor for receiving
and processing data; at least one memory array of variable resistance memory cells for
exchanging data with the processor; and a controller connected to the at least one
memory array, wherein the controller performs an algorithm which detects if the
resistance of any of the memory cells among the array is in a high resistance state, and
whether the resistance of any cells detected to be in the high resistance cells is below a
predetermined minimum level or is above a predetermined maximum level for the high
resistance state, controls application of at least one reset pulse to any cells detected to be
in the high resistance state and having a resistance either below the predetermined
minimum level or above the predetermined maximum level to thereby restore a
predetermined resistance range for the high resistance state, detects if the resistance of
any of the memory cells among the array is in a low resistance state, and whether the
resistance of any cells detected to be in the low resistance state is above a
predetermined maximum level or is below a predetermined minimum level for the low
resistance state, and controls application of at least one reset pulse to any cells detected
to be in the low resistance state and having a resistance either above the predetermined
maximum level or below the predetermined minimum level to thereby restore a

predetermined resistance range for the low resistance state." Parkinson does not teach such a processor system.

Applicants' recited processor system controls the application of at least one reset pulse which <u>restores</u> a programmed resistance of the memory cell, which is either above a predetermined maximum level or below a predetermined minimum level, to return to a predetermined programmed resistance range for the memory cell. Thus, the processor system controls the application of at least one reset pulse which <u>shifts</u>, <u>not</u> <u>refreshes</u>, the resistance of the memory cell such that its resistance level is <u>within</u> that predetermined programmed resistance range. Since Parkinson does not disclose the method of independent claim 67, Applicants respectfully request that the 35 U.S.C. § 102(e) rejection of claim 67 be withdrawn.

For at least the reasons provided above, claims 1, 2, 7, 10, 15, 23, 26, 28, 31, 33, 36, 38, 41, 43, 47, 48, 52-54, 59, 66, and 67 should be allowable over Parkinson. Withdrawal of the § 102(e) rejection is respectfully requested.

New claims 69-102 have been added to round out the scope of protection afforded the invention. The subject matter of these claims is also not anticipated by Parkinson.

In view of the above, each of the presently pending claims in this application is believed to be in condition for allowance. Accordingly, the Examiner is respectfully requested to pass this application to issue.

Dated: December 27, 2004   Respectfully submitted,

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